



RAILROAD COMMISSION OF TEXAS

HEARINGS DIVISION

OIL AND GAS DOCKET NO. 7C-0286667

THE APPLICATION OF RBD GROUP, LLC FOR A COMMERCIAL DISPOSAL WELL PERMIT PURSUANT TO STATEWIDE RULE 9 FOR THE SIEG 2 SWD LEASE, WELL NO. 1, SPRABERRY (TREND AREA) FIELD, REAGAN COUNTY, TEXAS

HEARD BY: Karl Caldwell - Technical Examiner
Terry Johnson - Hearings Examiner

PROCEDURAL HISTORY

Original Hearing Date:	March 14, 2014
Original PFD Issued:	October 30, 2014
Conference Date:	December 9, 2014
Motion for Rehearing Filed:	December 31, 2014
Motion for Rehearing Granted:	March 10, 2015
Pre-Hearing Conference:	April 9, 2015
Rehearing Date:	July 7, 2015
Transcript Received:	July 29, 2015
Amended PFD Issued:	September 30, 2015

APPEARANCES:

APPLICANT:

George Neale
Christopher Hotchkiss
Rick Johnston
C. DeWitt Walcott

REPRESENTING:

RBD Group, LLC

PROTESTANTS:

John Hays
Alicia Ringuett
Joe Peterson
Thomas Richter
Richard Brantley
James Buice

University Lands

RAILROAD COMMISSION:

Colin Lineberry
Jim Moore

EXAMINERS' REPORT AND PROPOSAL FOR DECISION**BACKGROUND**

At the Railroad Commission of Texas Conference on December 9, 2014, the Commissioners voted 2 - 1 to approve the application of RBD Group LLC ("RBD") for commercial disposal authority pursuant to 16 Tex. Admin. Code § 3.9 for its Sieg 2 SWD Lease, Well No.1, Spraberry (Trend Area) Field, Reagan County, Texas. On December 31, 2014, the Protestant timely-filed a Motion for Rehearing. At the Railroad Commission of Texas Conference on March 10, 2015, the Commissioners voted 2 - 1 to grant the Motion for Rehearing for the subject application. A pre-hearing conference was held on April 9, 2015 where the Applicant, Protestant, as well as Commission staff were informed that the scope of the rehearing was to receive additional evidence pertaining to: 1) the status of a 1928 wellbore ("1928 well"), API No. 42-383-01025, located greater than a quarter-mile but less than a half-mile from the subject well; and 2) the reservoir pressure of the San Andres Formation in the area. The reopened hearing was held on July 7, 2015.

CASE SUMMARY

The Applicant is requesting to inject a maximum volume of 25,000 barrels per day into the San Andres Formation between 3,520 feet and 4,150 feet. The top of the disposal interval has been lowered from the original application due to the discovery of incorrect documents that the Applicant had previously relied upon regarding the status of the 1928 well. University Lands is protesting the application based on:

- 1) injection into the San Andres Formation, which it believes may be over-pressured;
- 2) the potential for pollution of fresh water resources due to the proximity to a well drilled in 1928 to a total depth (TD) of 3,205 feet which may act as a conduit for injected fluids to escape the disposal interval;
- 3) the proposed location of the subject well being too close to University Lands' property and injectate from RBD's operations will migrate to University Lands' sub-surface; and
- 4) RBD could not operate under the applied-for permit because RBD does not have road access to the proposed site.

Based on the evidence in the record, the Examiners conclude that the top of the injection interval is below a confining interval and permit conditions will provide proper safeguards to adequately protect both ground and surface fresh water from pollution. The presence of confining intervals above and below the disposal interval will also protect oil

and gas formations in the area. Mud weights used to drill through the San Andres Formation within a two mile and a five mile radius indicate that the San Andres Formation is normally-pressured within a two mile radius and slightly above virgin or normal pressure on the northern edge of a five mile radius from the subject well location. The Examiners conclude that the application meets the requirements of law and recommend that it be approved.

APPLICABLE LAW

Any person who disposes of saltwater or other oil and gas waste by injection into a porous formation not productive of oil, gas, or geothermal resources shall be responsible for complying with 16 Tex. Admin. Code §3.9, Texas Water Code, Chapter 27, and Title 3 of the Natural Resources Code.

Pursuant to Texas Water Code § 27.051(b), the Commission has authority to permit disposal and injection wells if it finds:

- (1) that the use or installation of the injection well is in the public interest;
- (2) that the use or installation of the injection well will not endanger or injure any oil, gas, or other mineral formation;
- (3) that, with proper safeguards, both ground and surface fresh water can be adequately protected from pollution; and
- (4) that the applicant has made a satisfactory showing of financial responsibility if required by Section 27.073 of this code.

DISCUSSION OF THE EVIDENCE

Applicant's Evidence (RBD)

Application

RBD Group, LLC ("RBD") requests commercial disposal authority pursuant to Statewide Rule 9¹ for the Sieg 2 SWD Lease, Well No. 1, Spraberry (Trend Area) Field, Reagan County, Texas ("RBD Well No. 1"). The Sieg 2 SWD Lease, is a 6.62 acre tract located approximately 12 miles southwest of Big Lake, Reagan County, Texas. The proposed well location is 100 feet from the east line and 332 feet from the north line of Section 2, Georgetown Railroad Company, Abstract 946.

Notice of the application was published in the *Big Lake Wildcat*, a newspaper of

¹ 16 Tex. Admin. Code § 3.9 (Disposal Wells)

general circulation in Reagan County, Texas, on August 8, 2013. Notice of the application was sent to the Reagan County Clerk, the owner of the surface tract of the proposed disposal well, owners of surface tracts adjacent to the proposed disposal well location, and offset operators within a one-half mile radius.²

The application is protested by University Lands, an adjacent land owner. University Lands, under the direction of the Office of Business Affairs, The University of Texas Systems is responsible for managing the Permanent University Fund lands and the Trust Minerals.

Injection Interval

The Applicant proposes to inject salt water and RCRA-exempt³ waste into the San Andres Formation. In the original application the disposal interval was identified to be between 3,200 feet and 4,150 feet. In the reopened hearing, the Applicant submitted a revised Form W-14, lowering the top of the injection interval 320 feet, to a depth of 3,520 feet. The Protestant objected to the Applicant lowering the top of the injection interval, which was overruled by the Hearings Examiner.⁴

Gathering additional evidence to evaluate the potential for the 1928 well to act as a conduit for fluids to escape the disposal interval is one reason that the subject application was reopened. Rick Johnston, the Applicant's engineering witness, stated that the top of the disposal interval was lowered "so that the top of the disposal interval is now well below the stratigraphic equivalent of the TD [total depth] of the 1928 well. The TD of that 1928 well was 3,205 feet."⁵ Mr Johnston examined the nearest well with a modern suite of logs, and determined that a depth of 3,520 feet is appropriate for the top of the injection interval due to porosity development suitable for injection beginning at a depth of 3,526 feet. Above 3,526 feet, there are confining layers, including approximately 106 cumulative feet of non-permeable salt intervals.

Mr. Johnston acknowledges his pick of 3,520 feet is 10 feet shallower than Commission Staff's pick of 3,530 feet. Mr. Johnston believes 3,520 feet is more appropriate to ensure the disposal interval includes the top of the porous interval and all injectate will be confined to the injection interval.

² 16 Tex. Admin. Code § 3.9(5) (Notice and Opportunity for Hearing)

³ Resource Conservation and Recovery Act: Examples of RCRA exempt oil and gas waste includes produced water, drilling fluids, hydraulic fracturing flow back fluids, rig wash and workover wastes.

⁴ Based on Commission precedent, applicants are allowed to amend the disposal interval provided it remains within the upper and lower boundaries originally noticed to all affected parties and as noticed by publication. In addition, the amendment to the interval must not change the applicable Statewide Rule (i.e. from Statewide Rule 9 to Statewide Rule 46, or vice-versa).

⁵ Tr. (Rehearing), pg. 17, ln 4 - 6.

Confining Intervals

The nearest well to the proposed disposal well location with a modern suite of logs available is the University 1-1, No.1 (API No. 42-383-35557), located approximately one mile to the west-southwest. Mr. Johnston identified salt intervals from 3,288 feet to 3,356 feet and from 3,444 feet to 3,482 feet, that will act as a confining interval to prevent the vertical migration of fluid. "Good porosity development begins roughly at about 3,526 (feet). So that's why we're picking a top disposal interval of 3,520." ⁶ Mr. Johnston identified more than 250 feet of shale below the base of the proposed disposal interval. The shale interval below the disposal interval and the salt anhydrite intervals above the disposal interval will act as barriers that will prevent fluids from migrating from the disposal interval.

Well Construction

The Commission's Groundwater Advisory Unit (GAU) identifies the base of usable-quality water (BUQW) which must be protected to occur at a depth of 750 feet from the land surface at the proposed disposal well location. The Commission has identified the base of the underground sources of drinking water (USDW) to occur at a depth of 1,150 feet at the proposed disposal well location. The proposed injection interval from 3,520 feet to 4,150 feet would inject fluid below the base of the USDW.

The proposed surface casing program will set 9 5/8-inch, 36 lb-per-foot surface casing to a depth of 800 feet and circulate cement to surface to isolate and protect the BUQW. 7-inch, 23 lb-per-foot long string casing will be set at a depth of 4,200 feet and cemented with cement circulated to the surface. The tubing and packer will be set at a depth of 3,420 feet.

Nearby Wellbores***1928 Well***

In the original hearing, Mr. Johnston identified a dry hole that penetrated the top of the original injection interval.⁷ This dry hole is located approximately 0.47 miles⁸ east of the proposed disposal well location. The Applicant identified this well as API No. 42-383-01025. Mr. Johnston was unable to find plugging records for this well at the original hearing. However, the records that the Applicant relied upon at that time showed the well

⁶ Tr. (Rehearing), pg. 25, ln 20 - 22.

⁷ The original interval was from 3,200 feet to 4,150 feet.

⁸ Distance estimated to be approximately 2,500 feet from Applicant's Exhibit No. 6

was drilled in 1928 to a TD of 3,205 feet and that casing was set to a depth of 2,800 feet. The Applicant found a scout ticket, showing that casing was run. In Mr. Johnston's opinion, this casing would have been cemented in place. "Our records that we are able to come up with show that they ran casing to 2,800 feet. So what we are thinking is that when the casing was run, it was cemented in place so that the hole is cemented and it does not act - will not act as a conduit for the injected fluids to escape the injection interval."⁹

In the rehearing, Mr. Johnston stated that the Railroad Commission discovered that there was a paperwork error for the previously-identified 1928 well and the previous paperwork that the Applicant relied upon was incorrect. The paperwork that the Applicant referred to in the original hearing was discovered to be for a well located approximately four miles to the north of the actual well that is located slightly less than a half-mile east of the proposed disposal well location. The Continental University No. 1 (formerly Marland Oil Co.) is the actual well located just inside a half-mile to the east of the proposed disposal well location. This well was also drilled to a TD of 3,205 in 1928. The only records found for this well are drilling records. There is no information regarding casing or cementing. In the absence of paperwork, the Applicant is assuming that there is no cement behind the casing for this 1928 well. Since there is no evidence to show that this well has been properly plugged and will not act as a conduit, the Applicant has lowered the top of the injection interval to a depth of 3,520 feet to be below a confining interval.

Other Wellbores

There are no wellbores that penetrate the proposed disposal interval within a quarter mile radius of the proposed disposal well location. Drilling permits have been issued for two horizontal wells to be drilled in the surrounding area. The well plans indicate that the terminus points of the wells will be within a one-quarter mile radius, but the surface location of both wells are expected to be outside of the one-quarter mile radius. These two horizontal wells are targeting the Spraberry (Trend Area) Field, estimated to be at a depth between 6,000 feet and 8,000 feet in this area, which is greater than 1,800 feet below the proposed disposal interval. EP Energy E&P Company, LP ("EP") has permitted the two proposed horizontal wells. At the reopened hearing, it was determined that one of these wells has since been completed. The Applicant identified this well as API No. 383-38387, which appeared to be approximately one and a half miles from the subject well location. Staff's witness' recollection was that the well was cemented to surface for all casing strings and the well would not act as a conduit for fluids to escape the disposal interval.

San Andres Formation Pressure in the Area

Injection into the San Andres Formation in the Nearby Area

Two wells have injected fluids in the San Andres Formation within a five-miles radius

⁹ Tr. (Rehearing), pg. 20, ln 21 - pg. 21, ln 1.

of the proposed disposal well location: the University 122, No. 1D (API No. 42-383-38208), located approximately 4.5 miles to the northwest; and the University Conoco 25, No. 1 (API No. 42-383-31181), located approximately 4.2 miles to the north-northwest. According to data, the University Conoco 25, No. 1 ceased injection in 2013. In Mr. Johnston's opinion, there is no appreciable injection into the San Andres Formation within three-to-four miles of the proposed disposal well location.

Drilling Mud Weight Information

Mr. Johnston considers a normally-pressured saltwater gradient to be 0.46 psi per foot, which is equivalent to a mud weight of 8.8 ppg. The University 1-1, No. 1, (previously identified to be 1.1 miles west-southwest from the proposed disposal well location) was logged in 2006 with a drilling mud density of 8.6 pounds per gallon (ppg).¹⁰ In Mr. Johnston's opinion, when this well was drilled and logged the San Andres Formation in this area showed no indication of having abnormal or higher-than normal pressure since they were able to drill to this depth with this mud weight. "The premise on which we're relying is that when you drill through the San Andres, if it's geopressured...or abnormally higher-than-normal pressure...when you drill through it, you're going to have to increase your mud weight to control the water flow... So if you're able to drill to TD and the San Andres is open...the pore pressure or reservoir pressure of the San Andres has got to be less than whatever the mud weight was that you used to drill through it." ¹¹

The proposed disposal location is in the southwestern corner of Reagan County. The Applicant used mud weight as an indicator to study whether the San Andres Formation should be considered over-pressured in the entirety or certain areas of Reagan County. The Applicant complied Information on all wells drilled through all or part of the San Andres Formation completed in Reagan County since January 1, 2012 with a Form L-1 filing.¹² Based on mud weights, the majority of wells in the area immediately surrounding the proposed disposal well location reported mud weights of 9.4 ppg or less. In Mr. Johnston's opinion, the San Andres is not regionally over-pressured, based on the dispersion and the number of wells drilled with mud weights less than 9.5 ppg, and wells drilled with mud weights between 9.5 to 10.5. "There are large areas where I would say it's just normally pressured; otherwise they wouldn't have been able to drill these wells with these low mud weights." ¹³ Mr. Johnston expects the San Andres Formation to be normally pressured at the proposed disposal well location based on the mud weight that was used to drill the well approximately 1.1 miles from the proposed disposal well, in addition to the mud weight used to drill two other wells within two-to-three miles.

¹⁰ The density of fresh water is 8.33 ppg at 68 °F.

¹¹ Tr. (Rehearing), pg. 33, ln 10 - 21.

¹² Form L-1: Electric Log Status Report.

¹³ Tr. (Rehearing), pg. 36, ln 6 - 11.

Bottomhole Pressure Falloff Test Results

A bottomhole pressure falloff test was conducted on the Highway 137 SWD, No. 1 in March, 2015. This disposal well is located in approximately the center of Reagan County, 17 miles northeast of the proposed disposal well location. The Highway 137 SWD, No. 1 was perforated in the San Andres Formation from 3,156 feet to 3,740 feet. The test was performed prior to the well being in operation. Fluid was injected at a rate of 8 barrels per minute (bpm) for three hours and fifteen minutes before shutting the well in and monitoring the bottomhole pressure falloff. Mr. Johnston estimated the reservoir pressure to be 1,506 psi based on the test results. An estimated bottomhole pressure of 1,506 psi at a perforated depth of 3,156 feet equates to a pressure gradient at depth of 0.477 psi/foot, which is equivalent to a mud weight of 9.1 ppg. "When they TD'd the well, the reported mud weight in the hole at that time was 10 ppg. The purpose of mud is to prevent the well from flowing, and what this bottomhole measurement shows is that they had mud weight way higher than they needed to."¹⁴

Mr. Johnston noted that an area in Reagan County thirty-three miles to the northeast of the proposed disposal well location, the Von Gonten area, has been identified as a bradenhead pressure problem area by the Commission. "I believe the San Andres has become pressured up. To my knowledge, this is the only problem area in Reagan County where people are having bradenhead pressure problems...I would say this localized pressurization issue 33 miles away has no bearing on what's going on down at the proposed [disposal well] location"¹⁵

After lowering the top of the disposal interval and studying the San Andres Formation pressure Mr. Johnston does not believe that the 1928 well will be a conduit for injected fluids to escape the injection interval. On-cross examination Mr. Johnston stated that he has not prepared any pressure front calculations. Mr. Johnston defines the formation fracture pressure as "the pressure at which you fracture the formation...create and propagate a fracture."¹⁶ Mr. Johnston does not know the formation fracture pressure of the San Andres Formation, or the Grayberg Formation immediately above the San Andres Formation - "I don't have any step-rate test, which is what you would need to identify that."

Oil and Gas Activity and Disposal Wells in the Area

Mr. Johnston testified that there is a need for additional disposal capacity in the area. There are 200 producing wells and numerous drilling rigs within a ten mile radius of

¹⁴ Tr. (Rehearing), pg. 44, ln 17 - 21.

¹⁵ Tr. (Rehearing), pg. 41, ln 11 - pg 42, ln 7.

¹⁶ Tr. (Rehearing), pg. 51, ln 12 -14.

the proposed location of RBD Well No. 1. Commission records show one active commercial disposal well within a ten mile radius of the proposed disposal well location, the GulfTex Energy University Lands SWD Lease, Well No. D-2 ("Well No. D-2"). This well is permitted for a maximum volume of 3,000 bpd, injecting into an interval from 3,000 feet to 3,500 feet. Mr. Johnston stated that Well No. D-2 is designed to dispose of piped-in fluids only and the proposed RBD Well No.1 would be the only commercial saltwater disposal well within a ten mile radius that would accommodate commercial saltwater disposal trucks.

Financial Assurance

RBD is an active P-5 operator with the Commission and has a \$25,000 letter of credit on file with the Commission as financial assurance.

Railroad Commission Staff's Evidence

Status of 1928 Well, API No. 383-01025

According to Jim Moore, an Engineering Specialist with the Technical Permitting Section, the linen map information for well API No. 383-01025, referred to as the 1928 well, lists Marland as the operator, the TD of the well to be 3,205 feet, and that the well was plugged and abandoned on April 25th, 1928. Mr. Moore considers the 1928 well to be an "unknown status wellbore."¹⁷ The Commission's mainframe lists the status of the 1928 well as a dry hole.

Analysis of the Proposed Injection Interval and the 1928 Well

The same well log used by the Applicant was also independently analyzed by Mr. Moore (University 1-1, No.1, located approximately one mile to the west-southwest). This log was selected since it was the nearest well log to the proposed disposal well in the Commission's Neubus system. Mr. Moore's opinion "is that lowering the injection interval top to...3,520... would isolate the injection interval from the 1928 well, and the intervening layers would prevent any vertical migration of fluid that could, under high enough pressure, force the fluid up through the 1928 well if it's not properly plugged. But since the proposed injection interval would be isolated from that well, then that's not going to happen- that's not predicted to happen."¹⁸ Mr. Moore's analysis concludes that "there are impermeable layers between 3,200 feet and 3,530 feet that would act to - act as geological isolation to prevent injected fluids from migrating vertically. Of course, the vertical migration depends on the pressure differential. There has to be enough pressure differential for the fluid to actually push back up through the rock. And so as pressure increases, in the injection interval, you're really still just looking at the difference between normal pressure and the pressure increase. And that pressure increase has to have enough force to push its way through these intervals. And so these intervals would tend to act as geological isolation

¹⁷ Tr. (Rehearing), pg. 68, ln 18.

¹⁸ Tr. (Rehearing), pg. 82, ln 16 - 25.

for a pretty large range of pressure...by lowering the interval... 320 feet, to me indicates that the 1928 well...would not be in contact with the injection interval, and the fluids would not migrate vertically up into that unknown status wellbore”¹⁹

Mr. Moore testified that there is a good porosity interval starting at 3,530, and the interval from 3,530 feet to 3,830 feet is a good disposal interval. By the depth of 4,200 feet, the well log indicates a shaley carbonate which would be a geological isolation below the injection interval. Above the injection interval there are layers of salt that would act as isolation layers from 3,290 feet to 3,360 feet and from 3,440 feet to 3,490 feet.

On cross-examination by the Protestant, Mr. Moore stated that he did not consider any natural or artificial fractures in the confining intervals in concluding that injected fluids would not migrate to the 1928 well. Mr. Moore did not take into account any artificial fractures that might be caused by the injection of fluids in the proposed disposal well since the standard application review and guidelines are intended to prevent injection pressures that could fracture either the injection interval or the confining interval. Mr. Moore considers the San Andres Formation porosity and permeability to be normal carbonate porosity and permeability.

On questioning by the Applicant, Mr. Moore stated that the standard to avoid injection pressures that may approach the fracture initiation pressure. Based on the Applicant's revised top-of-injection interval of 3,520 feet, the maximum surface injection pressure that would be allowed by the Commission's UIC section would be 1,760 psig. The Applicant is requesting a maximum surface injection pressure of 1,600 psig, less than the maximum allowable by guidelines for the depth interval.

Analysis of San Andres Formation Pressure

The subject application originally received an administrative denial letter dated November 15, 2013 that Mr. Moore would categorize as a geologic-geographic restriction; geologic in terms of the San Andres Formation, and geographic in the area of both Reagan and Upton Counties. On December 23, 2013, the Applicant received a retraction letter of the administrative denial. Mr. Moore did not work on the administrative review of the subject application and does not know why the original decision for a moratorium was retracted. In Mr. Moore's opinion, it may have been due to being too broad of a geographic restriction.²⁰

Mr. Moore participated in a study of the Von Gonten area of Reagan County, a reported pressure-problem area. The Von Gonten area is described to be a two-mile radius surrounding API No. 383-31488, approximately 30 miles from the proposed disposal well and the same region that the Applicant referred to in previous testimony. The study consisted of field inspection reports, which included high Bradenhead pressures, saltwater flows, and flow down tests “that showed that the saltwater flows would build back up after

¹⁹ Tr. (Rehearing), pg. 67, ln 17 - pg. 68, ln 18.

²⁰ Tr. (Rehearing), pg. 78, ln 16 - 17.

about 30 minutes which can indicate that disposal interval could be influencing the Bradenhead pressures. There was also some anecdotal information consisting of phone calls from operators that plugging costs...up to 10 times higher than if there were no problems.”²¹

Mr. Moore did not have any bottomhole shut-in pressure test information within a five mile radius of the subject well location, but considers well log headers to be the next best source of information. Mud weight “is a reasonable way to estimate the bottom-hole pressure. It is typically 0.1 or 0.2 ppg higher than the actual formation pressure, so it creates a ceiling or a maximum value that can be converted to pressure.”²² The only well with an open hole log for the San Andres Formation within two miles of the subject well location is the University 1-1 No.1, the same log previously used for the type log. The well was logged on October 7, 2006 and reported a mud weight of 8.6 ppg, which converts to a pressure gradient of 0.447 psi/ft.

Three well logs that were logged open-hole and included at least part of the of the San Andres Formation were available between two and five miles from the subject well location. The mud weight ranged from 9.1 to 10.4 ppg for these three wells, which converted to pressure gradients ranging from 0.47 psi per foot to 0.54 psi per foot. In Mr. Moore’s opinion “that range from 9.1 pounds per gallon to 10.4 pounds per gallon is - it’s in the normal range of mud weight, close to a normal pressure, or a virgin pressure. .. 10.4 is a little bit higher than what you might call virgin pressure for this area, but it is not considered over-pressured.”²³ In Mr. Moore’s opinion, the pressure may be greater in those wells further from the proposed well site due to injection activity. For example the University-Conoco No. 25, No. 1 is reported to be completed from 3,358 to 3,520 feet, which correlates to the San Andres Formation and records show a cumulative injection volume of 10 million barrels. -“so that 10 million barrels cumulative...could account for the higher mud weight at the north part of that five-mile radius” from the proposed well location.²⁴

On cross-examination by the Protestant, Mr. Moore stated that the volume of fluid injected and initial bottomhole pressure are two factors related to formation pressure. Mr. Moore stated that the University Conoco 25, No. 1 is an injection well located approximately five miles to the north of the proposed well site which could account for the higher mud weight in the San Andres Formation in that area. The cumulative injection volume for this well is 10 million barrels. The University 1-22 No. 1D is a relatively new well that shows 300,000 barrels cumulative disposal. In Mr. Moore’s opinion, “I do think that’s an analog for the proposed well.”²⁵

²¹ Tr. (Rehearing), pg. 80, ln 3 - 12.

²² Tr. (Rehearing), pg. 71, ln 4 - 8.

²³ Tr. (Rehearing), pg. 75, ln 2 - 8.

²⁴ Tr. (Rehearing), pg. 76, ln 12 - 15.

²⁵ Tr. (Rehearing), pg. 76, ln 22 - 23.

On cross-examination by the Applicant, Mr. Moore stated that the subject of formation pressurization needs extensive study. Aside from the Von Gonten area, Mr. Moore is not familiar with any other high pressurization areas other than some anecdotal water flow during plugging data that is more widespread across the county and could vary in severity.

Protestant's Evidence (University Lands) - Rehearing

Joe Peterson, a Senior Range Conservationist for University Lands located the surface location of the 1928 well in question. Mr. Peterson determined that the location of the 1928 well is approximately 180 feet northwest of the GPS co-ordinates listed on the Commission's website and estimates the well to be 2,429 feet from the proposed location for the subject well. Upon inspection, Mr. Peterson encountered something hard [solid] in the wellbore at a depth of approximately five feet. Mr. Peterson could not tell whether it was a plug or some type of material that had been dropped in the hole.

There are two non-commercial, on-lease disposal wells injecting into the San Andres Formation in the nearby area. The daily average injection volume for the University 122, 1D is 410 bpd into the San Andres Formation. This well was previously-identified by both the Applicant and Commission Staff as the only well within five miles of the proposed disposal well that is currently injecting the San Andres Formation. The State SD Lease, Well No 1 (API. No. 42-383-30692) is injecting an estimated 230 bpd into the San Andres Formation. This well is located approximately 5.7 miles to the north-northeast of the proposed disposal well location.²⁶

Within two to three miles from the proposed disposal well location there is production from the Grayberg and Queen Fields. The Grayburg Formation is located directly above the San Andres Formation and is contiguous to the San Andres Formation. If injected fluids were to somehow migrate through the confining intervals in the San Andres Formation, fluids could continue to migrate up to the Grayberg Formation. The Protestant does not know the fracture gradient ("frac gradient") of the impervious salt intervals within the San Andres Formation. The Protestant is concerned whether vertical fractures would be created from the injection of fluids in the range of 10,000 to 20,000 bpd in the subject well if the frac gradient of the impervious salt interval within the San Andres Formation is less than that of the San Andres Formation. According to Thomas Richter, the Protestant's engineering witness, "water is going to seek the lowest pressure, wherever that is, if it's out of the formation or if it's through... fracture systems that go up."²⁷ On cross-examination the Protestant's engineering witness stated that he had performed pressure-front calculations at depths of 3,200 feet and 3,350 feet. However, when the top of the interval was lowered to 3,520 feet it eliminated these calculations.

²⁶ The distance of 5.7 miles estimated from Protestants' Exhibit No. 7 map.

²⁷ Tr. (Rehearing), pg. 132, ln 3 - 5.

Protestant's Evidence (University Lands) - Original Hearing

Extensive oilfield activity is conducted on properties owned by University Lands, including the operation of an estimated ten to twenty saltwater disposal wells on its nearby property. University Lands has three different contractual arrangements for saltwater disposal with the salt water disposal well operators:

- (1) a single operator (lessee) disposing of on-lease (University Lands) water;
- (2) water disposal of University Lands water from multiple tracts;
- (3) disposal of University Lands water and non-University Lands water.

According to University Lands, at 150 feet ²⁸ from the property line, the location of RBD's commercial disposal well is too close to its property and injectate from RBD's operations will migrate to University Lands' sub-surface. University Lands requires operators on its leases to enter into a contract if the operator is requesting to commingle water from multiple oil and gas leases for disposal. This requirement is a result of the operator not owning the surface rights. James Buice, University Lands' witness stated that operators who approach University Lands for an SWD contract to commingle water from multiple oil and gas leases are required to obtain a permit from University Lands. According to the Mr. Buice, an operator needs to obtain a contract from University Lands "at the point that water leaves the contiguous oil and gas lease, once it crosses the lease boundary."²⁹

University Lands argues that the San Andres interval is too shallow for injection and suggested the deeper Ellenburger Formation as more suitable for RBD's proposed operations. In support of this position, University Lands' witness stated that water deeper than 800 feet in this area is "very good" water. However, University Lands acknowledges that it has previously allowed producing wells on its property to be converted into disposal wells which inject into the San Andres Formation. University Lands draws a distinction between these wells and RBD's commercial disposal well, asserting that only water which has been generated on-lease, and wells that have been converted from producing wells to disposal wells have been allowed to inject into the San Andres formation on University Lands' property.

Finally, University Lands contends that RBD could not operate under the applied-for permit because RBD does not have road access to the proposed site. The county road does not extend to the proposed disposal well location.

²⁸ RBD's expert engineering witness testified that the distance from the proposed disposal well location to the property line is 100 feet.

²⁹ Tr. (Original Hearing), pg. 44, ln 19 - pg. 45, ln 1.

Applicant's Rebuttal Testimony (Original Hearing)

C. DeWitt Walcott, RBD's manager, testified that RBD consulted with an attorney as well as with Reagan County authorities regarding access to the county road. Reagan County officials have indicated to Mr. Walcott that the road is maintained up to the gate of the proposed disposal well location.

In response to University Lands' claim of subsurface trespass, Mr. Walcott stated that with the exception of some Grierson leases, all oilfield activity in the vicinity of the proposed disposal well occurs on University Land leases and the water injected into the proposed RBD Well No. 1 will have been produced from University Lands strata.

EXAMINERS' ANALYSIS OF THE EVIDENCE

The Examiners conclude that the subject application satisfies the requirements of 16 Tex. Admin. Code §3.9, Texas Water Code, Chapter 27, and Title 3 of the Natural Resources Code. In contrast, University Lands has failed to rebut RBD's evidence. The Examiners' recommend that the application for commercial disposal authority pursuant to Statewide Rule 9 for the Sieg 2 SWD Lease, Well No. 1, Spraberry (Trend Area) Field, Reagan County, Texas, be approved.

San Andres Formation Pressure at the Proposed Well Location

The evidence of record shows that no wells have injected fluids in the San Andres Formation within four miles of the proposed disposal well location. There are two active disposal wells injecting into the San Andres Formation, one approximately 4.5 miles to the northeast, the other approximately 5.7 miles to the north-northeast. The current daily average injection volume for each well is less than 1,000 bpd. The University Conoco 25, No. 1 located approximately 4.2 miles to the north-northwest has injected a cumulative volume of 10, million barrels of fluid ceased injection The University Conoco 25, No. 1 is located approximately 4.2 miles to the north-northwest from the proposed well location. This well injected a cumulative volume of 10 million barrels of fluid into the San Andres Formation before ceasing operation in 2013.

Mud weight may be used to estimate formation pressure. Both the Applicant's and Staff's study of mud weights used to drill through a part or the entire San Andres Formation ranged from 8.6 ppg to 10.4 ppg (0.47 psi per foot to 0.54 psi per foot) within a two-to five mile radius. Staff's witness considered the high range to be slightly above normal or virgin pressure, but not over-pressured. The higher mud weights were observed approximately 4.5 miles north-northwest of the proposed disposal well location. This was attributed to the cumulative injection of 10 million barrels of fluid in the University Conoco-25, No. 1 injection well. Injection in this well was into an interval from 3,358 feet to 3,520 feet, estimated to be in the San Andres Formation.

There is evidence that the Von Groten area, estimated to be 30 to 33 miles to the northwest of the proposed well location has experienced some pressurization. A bottomhole pressure falloff test conducted in the San Andres Formation for a well located

approximately halfway between the subject well location and the Von Groten area resulted in an estimated San Andres Formation pressure of 0.477 psi per foot. This is slightly greater than the 0.46 psi per foot that the Applicant considers to be a normally-pressured saltwater gradient. This test result is the only direct estimate of San Andres Formation pressure in the record.

There was no contradictory evidence to rebut the Applicant's and Staff's evidence. In the absence of a San Andres Formation pressure test result at the proposed disposal well location, the Examiners conclude that the San Andres Formation is in the range of a slightly above normal saltwater gradient at the proposed disposal well location at this time. This characterization is considering 0.46 psi per foot to be a normal saltwater gradient.

No Endangerment or Injury to Any Oil, Gas, or Other Mineral Formations

Based on the evidence, the Examiners conclude that the installation and use of the injection well will not endanger or injure any oil, gas, or other mineral formation. Both the Applicant's engineering witness and Staff's witness provided independent evidence and analysis that reached the same conclusions. Both witnesses concluded that there is geological isolation above the top of the disposal interval from approximately 3,290 feet to approximately 3,526 feet or 3,530 feet. There is also approximately 250 feet of shale intervals below the base of the disposal interval at 4,150 feet to prevent the vertical migration of fluids from the disposal interval.

There are no active producing wells within a one-quarter mile radius of the proposed disposal well location. Two drilling permits for horizontal wells have been issued within a one-quarter mile radius of the proposed disposal well. The terminus points of both wells will enter the one-quarter mile radius, but the surface location of both wells are expected to be outside of the one-quarter mile radius. These two horizontal wells are permitted in the Spraberry (Trend Area) Field, estimated to be more than 1,800 feet deeper than the proposed disposal interval. At the reopened hearing, it was determined that one of these wells has since been completed. The Applicant identified this well as API No. 383-38387, which appeared to be approximately one and a half miles from the subject well location. Staff's witness's recollection was that the well was cemented to surface for all casing strings and the well would not act as a conduit for fluids to escape the disposal interval.

The Applicant identified more than 250 feet of shale below the injection interval to prevent fluids from migrating to productive intervals below the disposal interval. The well log analysis by Commission Staff's witness concluded geological isolation below the injection interval due to the log interpretation of shaley carbonate intervals below the disposal interval.

Adequate Protection of Ground and Surface Fresh Water

With proper safeguards, both ground and surface fresh water will be adequately protected from pollution. The Commission's GAU identifies the BUQW at a depth of 750 feet from the land surface. The proposed surface casing program will set 9 5/8-inch surface casing to a depth of 800 feet and circulate cement to the surface to isolate and

protect the BUQW.

The Commission's GAU identifies the base of the USDW at the proposed disposal well location to occur at a depth of 1,150 feet. The proposed disposal interval from 3,520 feet to 4,150 feet will inject fluid below the base of the USDW. There are no open wellbores that penetrate the disposal interval within a quarter-mile radius. The 1928 well is an unknown status wellbore with a TD of 3,205 feet, which is located approximately 2,429 feet from the proposed well location. This wellbore does not penetrate the proposed disposal interval as the top of the disposal interval is below the stratigraphic equivalent depth of the 1928 well. Both the Applicant's engineering witness and Commission Staff's witness provided evidence of impermeable layers between 3,250 feet and 3,520 feet that will prevent fluids from migrating vertically above the disposal interval. After considering the evidence, both the Applicant's engineering witness and Staff's witness opined that the 1928 well will not act as a conduit for injected fluids to escape the disposal interval. The Examiners' are in agreement with this assessment.

The Protestant raised a concern as whether natural fractures may exist in the confining intervals, or whether the injection of fluids may induce man-made fractures that may allow fluids to escape the disposal interval. There is no evidence to show that injecting 10,000 to 20,000 bpd into the San Andres Formation will cause the confining intervals to hydraulically fracture as a direct result of fluid volume injected. The bottomhole pressure would have to reach the fracture initiation pressure to create fractures, and the Commission's guideline to prevent this occurrence in this area is to restrict the maximum surface injection pressure to be a maximum of 0.5 psi per foot to the top of the injection interval.³⁰ The Applicant is requesting a maximum surface pressure 160 psi less than the maximum pressure allowable by Commission guidelines for the proposed injection interval.³¹ In addition, Staff's witness considers the University 1-22 No. 1D to be an analog for the proposed disposal well. The Protestant's engineering witness testified that this is a non-commercial, on lease, low disposal volume well, injecting less than 1,000 barrels per day. However, Protestant's Exhibit No. 7-Well No. 6, shows the well is permitted for a maximum surface injection pressure of 1,550 psi, or 0.5 psi per foot, the maximum surface injection pressure permitted by Commission guidelines for the injection interval listed as 3,100 feet to 4,350 feet. This well is also permitted for a maximum daily volume of 18,000 bpd. Staff's witness testified that is not an area where the Commission's guideline for maximum surface injection pressure has been lowered below 0.5 psi per foot to the top of the injection interval. Based on the evidence in the record, the Examiners conclude that there is no evidence to show that permitting an injection interval in the San Andres Formation at the proposed disposal well location for a maximum daily volume of 25,000 barrels with a maximum surface injection pressure at or below 0.5 psi per foot will cause vertical fractures in the confining intervals.

³⁰ The permitted pressure will not exceed 0.5 psi per foot of depth to the top of the injection/disposal interval, unless the results of a fracture pressure step-rate test support a higher pressure. (<http://www.rrc.state.tx.us/oil-gas/publications-and-notices/manuals/injectiondisposal-well-manual/summary-of-standards-and-procedures/technical-review/>)

³¹ The Applicant is requesting a maximum surface injection pressure of 1,600 psig, whereas the maximum surface injection pressure using the 0.5 psi per foot Commission guideline for a top of injection interval at 3,520 feet would be 1,760 psig.

Public Interest

In the Examiners opinion, RBD has adequately demonstrated that the use or installation of the injection well would be in the public interest³² as there is a need for commercial disposal capacity in the area. RBD Exhibit No. 16 identifies more than twenty-five active wells within a two and one-half mile radius of the proposed disposal well. RBD's evidence indicates that there are 200 producing wells within a ten mile radius of the proposed location. RBD Exhibit No. 11 shows that there are numerous active drilling rigs in the area surrounding the proposed disposal well location. There is only one active commercial disposal well within a ten-mile radius of the proposed RBD Well No. 1, which is permitted to dispose of a maximum volume of 3,000 bpd, injecting into an interval between 3,000 feet and 3,500 feet.

Financial Responsibility

The Examiners conclude that RBD has made a satisfactory showing of financial responsibility as required by Section 27.073 of the Texas Water Code. RBD submits that it has the expertise to build and manage the proposed well. RBD has a current approved Form P-5 (Organization Report) and a \$25,000 cash deposit for financial assurance. There is no evidence to suggest any current active enforcement matters involving RBD.

Additional Stated Reasons for University Lands' Protest of Application

University Lands is also protesting the application due to the proximity of the well to University Lands property which may lead to a subsurface trespass and road access to the proposed disposal well location. University Lands has failed to demonstrate how injectate from RBD's operations will threaten ground or surface fresh water, or otherwise endanger or injure any oil, gas, or other mineral formation. Further, University Lands failed to rebut the Applicant's evidence regarding whether Reagan County will maintain a road to the proposed facility.

FINDINGS OF FACT

1. RBD requests commercial disposal authority pursuant to Statewide Rule 9 for the Sieg 2 SWD Lease, Well No. 1, Spraberry (Trend Area) Field, Reagan County, Texas.
2. Notice of the RBD's application was published in the *Big Lake Wildcat*, a newspaper of general circulation in Reagan County, Texas on August 8, 2013.

³² Texas Water Code 27.051(b)'s "public interest" finding is limited to matters related to oil and gas production, and does not include issues such as traffic safety and road conditions.

3. Notice of the application was sent to the Reagan County Clerk, the owner of the surface tract of the proposed disposal well, all landowners of all tracts adjacent to the proposed disposal well location, and all offset operators within a one-half mile radius.
4. With proper safeguards, both ground and surface fresh water can be adequately protected from pollution.
 - a. The base of useable-quality water that must be protected is from the land surface to a depth of 750 feet. In conformity with this recommendation:
 - i. The well will have 9 5/8-inch, 36 lb. per foot, surface casing set at 800 feet inside a 12 1/4-inch hole and cementing in place with an estimated 250 sacks of Class C cement, circulated back to surface. This is 50 feet deeper than the BUQW;
 - ii. 7-inch, 23 lb. per foot, long string of casing will be set to a depth of 4,200 feet inside an 8 3/4-inch hole and cemented in place with 550 sacks of Class H cement, with cement circulated to surface;
 - iii. 4 1/2-inch tubing will be run inside the 7-inch casing and a packer will be set on the end of the tubing at 3,420 feet;
 - iv. Injected fluids will be confined to the San Andres Formation with a permitted interval from 3,520 feet to 4,150 feet;
 - v. There are no wellbores within a one-quarter or one-half mile radius of the proposed disposal well location that penetrate the proposed disposal interval;
 - vi. The top of the injection interval at 3,520 feet at the subject well location is below the stratigraphic equivalent of the 1928 well (API No. 383-01025), which is an unknown status wellbore located 2,429 feet away that was drilled to a TD of 3,205 feet;
 - vii. There is geological isolation from 3,290 feet to 3,526 feet to prevent fluids from migrating above the top of the disposal interval;
 - viii. The maximum surface injection pressure will be 1,600 psi; and
 - ix. The maximum daily injection volume will be 25,000 bpd.
5. The use or installation of the disposal well will not endanger or injure oil, gas, or other mineral formation.

- a. Injected fluids will be confined to the San Andres Formation with a permitted interval from 3,520 feet to 4,150 feet;
 - b. There is 250 feet of impermeable shale intervals below the disposal interval to prevent fluids from migrating below the permitted disposal interval; and
 - c. There is geological isolation from 3,290 feet to 3,526 feet to prevent fluids from migrating above the top of the disposal interval.
6. The use or installation of the injection well is in the public interest:
 - a. There is only one existing commercial disposal well within a 10-mile radius which is permitted for a maximum volume of 3,000 bpd; and
 - b. there are more than twenty-five active wells within a two and one-half mile radius of the proposed disposal well and 200 producing wells within a ten mile radius of the proposed location.
7. There is no evidence in the record of over pressurization of the San Andres Formation at the proposed disposal well location for the Sieg 2 SWD Lease, Well No. 1 at this time.
 - a. Mud weights used to drill through all or a portion of the San Andres Formation within a 5-mile radius of the proposed location ranged between 8.6 ppg and 10.4 ppg; and
 - b. In March, 2015, the reservoir pressure of the San Andres Formation at the Highway 137 SWD, No. 1 location was 1,506 psi, a pressure gradient at depth of 0.477 psi per foot.
 - i. The Highway 137 SWD, No. 1, is located 17 miles northeast of the proposed disposal well location;
 - ii. the Highway 137 SWD, No. 1, is located between the proposed disposal well location and the Von Groten area;
 - iii. The Highway 137 SWD, No. 1 was perforated in the San Andres Formation from 3,156 feet to 3,740 feet; and
 - iv. The bottomhole pressure falloff test was conducted for the Highway 137 SWD, No. 1 well in March, 2015 prior to commencing disposal operations.
8. RBD has made a satisfactory showing of financial responsibility.

CONCLUSIONS OF LAW

1. Resolution of the subject application is a matter committed to the jurisdiction of the Railroad Commission of Texas. TEX. NAT. RES. CODE § 81.051.
2. All notice requirements have been satisfied. 16 TEX. ADMIN. CODE § 3.9.
3. The proposed fluid disposal operations will not cause the pollution of freshwater strata and will not endanger oil, gas or geothermal resources. 16 TEX. ADMIN. CODE § 3.9.
4. RBD Group, LLC. has met its burden of proof and its application satisfies the requirements of Chapter 27 of the Texas Water Code and the Railroad Commission's Statewide Rule 9.

EXAMINERS' RECOMMENDATION

Based on the above findings of fact and conclusions of law, the Examiners recommend that the application of RBD Group, LLC. for commercial disposal authority pursuant to Statewide Rule 9 for the Sieg 2 SWD Lease, Well No. 1, Spraberry (Trend Area) Field, Reagan County, Texas, be approved, as set out in the attached Final Order.

Respectfully submitted,



Karl Caldwell
Technical Examiner



Terry Johnson
Hearings Examiner